

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: ERIC COMPTON Examiner #: 77132 Date: 1/6/04
Art Unit: 3726 Phone Number 305-0240 Serial Number: 10/069,384
Mail Box and Bldg/Room Location: CP2 E A13 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: NITINOL BALL BEARING ELEMENT AND PROCESS FOR MAKINGInventors (please provide full names): JULIEN GERALDEarliest Priority Filing Date: 8/19/1999

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

BALL BEARING + NITINOL (SHAPE-MEMORY ALLOY)
ROLLER BEARING

RACE ELEMENT

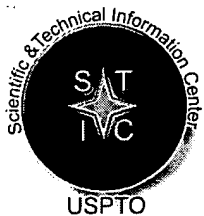
AMENDED / CLAIM 20, CLAIM 9 / Secondary
8

RACE OR
BALL

See attached
"amended" claims

STAFF USE ONLY

Type of Search		Vendors and cost where applicable	
Searcher: <u>EMORY DAMRON</u>	NA Sequence (#) _____	STN <input checked="" type="checkbox"/> <u>217.70</u>	
Searcher Phone #: <u>3058587</u>	AA Sequence (#) _____	Dialog <input checked="" type="checkbox"/> <u>670.48</u>	
Searcher Location: <u>CP2 208</u>	Structure (#) _____	Questel/Orbit _____	
Date Searcher Picked Up: <u>1/6/04 10am</u>	Bibliographic <input checked="" type="checkbox"/>	Dr.Link _____	
Date Completed: <u>1/6/04 3:15 PM</u>	Litigation <input checked="" type="checkbox"/>	Lexis/Nexis _____	
Searcher Prep & Review Time: <u>120 min</u>	Fulltext <input checked="" type="checkbox"/>	Sequence Systems _____	
Clerical Prep Time: <u>0</u>	Patent Family _____	WWW/Internet <input checked="" type="checkbox"/>	
Online Time: <u>165 min</u>	Other _____	Other (specify) _____	



STIC Search Report

EIC 3700

STIC Database Tracking Number: 111446

TO: Eric Compton
Location: cp2 5a13
Art Unit: 3726
Tuesday, January 06, 2004

Case Serial Number: 10/069384

From: Emory Damron
Location: EIC 3700
CP2-2C08
Phone: 305-8587

Emory.Damron@uspto.gov

Search Notes

Dear Eric,

Please find below an inventor search in the bibliographic and full-text foreign patent files, as well as keyword searches in the patent and non-patent literature files, both bibliographic and full text.

References of potential pertinence have been tagged, but please review all the packets in case you like something I didn't.

In addition to searching on Dialog, I also searched Google, EPO/JPO/Derwent, and STN.

Please contact me if I can refocus or expand any aspect of this case.

Happy New Year!

Sincerely,
Emory Damron
Technical Information Specialist
EIC 3700, US Patent & Trademark Office
Phone: (703) 305-8587/ Fax: (703) 306-5915
Emory.damron@uspto.gov





STIC Search Results Feedback Form

EIC 3700

Questions about the scope or the results of the search? Contact *the EIC searcher* or contact:

John Sims, EIC 3700 Team Leader
308-4836, CP2-2C08

Voluntary Results Feedback Form

➤ I am an examiner in Workgroup: Example: 3730

➤ Relevant prior art **found**, search results used as follows:

- ☐ 102 rejection
- ☐ 103 rejection
- ☐ Cited as being of interest.
- ☐ Helped examiner better understand the invention.
- ☐ Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- ☐ Foreign Patent(s)
- ☐ Non-Patent Literature
(journal articles, conference proceedings, new product announcements etc.)

➤ Relevant prior art **not found**:

- ☐ Results verified the lack of relevant prior art (helped determine patentability).
- ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to STIC/EIC3700 CP2 2C08



=> d his

(FILE 'HOME' ENTERED AT 14:21:38 ON 06 JAN 2004)

FILE 'ALUMINIUM, HCAPLUS, MATBUS, METADEX, EMA, AEROSPACE, CONFSCI,
RUSSCI' ENTERED AT 14:22:30 ON 06 JAN 2004

L1 36435 S NITINOL OR SHAPE MEMORY OR SHAPEMEMORY OR NITI OR NI TI OR TI
L2 42379 S SMA OR SMM OR SME OR MARTEN? (5N) AUSTEN? OR TINI OR TI NI
L3 69592 S L1-L2
L4 7800 S BALL BEARING? OR BEARING BALL? OR RACE BEARING? OR BEARING RA
L5 5857 S ROLLER BEARING? OR NEEDLE BEARING? OR BEARING CAGE? OR CAGE B
L6 12648 S L4-L5
L7 96 S L3 AND L6
L8 90 S L7 AND PY<=2000
L9 79 DUP REM L8 (11 DUPLICATES REMOVED)

L9 ANSWER 4 OF 79 AEROSPACE COPYRIGHT 2004 CSA on STN

ACCESSION NUMBER: 2002:007231 AEROSPACE

DOCUMENT NUMBER: A98-36400

TITLE: **Shape memory** wire as a drive mechanism
for a Fourier transform spectrometer

AUTHOR(S): Brasunas, John, (NASA, Goddard Space Flight Center,
Greenbelt, MD)

SOURCE: Optical Engineering, (Jun 1998) vol. 37, no.
636908, pp. 1882, 1883. Refs: 4. Available from: Aeroplus
Dispatch.
ISSN: 0091-3286

PUB. COUNTRY: United States

DOCUMENT TYPE: Journal

LANGUAGE: English

AB This paper examines the use of **shape memory** wire as a potentially much lighter and cheaper alternative to the voice-coil motor of a Fourier transform spectrometer (FTS). For instance, **Flexinol**, which is manufactured by Dynalloy, Inc., of Irvine, CA, is a shape (length) memory alloy actuator wire made of nickel and titanium. When prestretched at room temperature and then electrically driven (heated), it contracts. The alloy changes its internal structure at a transition temperature (typically set at 70-90 C). The contraction during heating may be as great as a few percent. The wire can then be stretched again when cooled, and this can be repeated many times. The motion (stroke) of the memory wire is set by the stress one uses to stretch the below-transition wire. For 10,000-psi loading, the stroke is about a four-percent stretch. For 0.010-in.-diameter **Flexinol**, the maximum pull is 930 g. In comparison, the voice-coil motor may supply a force up to one lb. A servo-controlled FTS experimental setup using 30 cm of 0.010-in.-diameter **Flexinol** as a **shape memory** wire drive is demonstrated. The results show that for the same FTS servo network, tachometer, and **ball-bearing** slide, the memory wire drive has a speed variation that is about a factor of two worse than the voice-coil drive. This is, nevertheless, a respectable performance, since a 9.5-percent speed variation for such a low speed as 55-micron/s is still useful for Fourier transform spectroscopy.

TI **Shape memory** wire as a drive mechanism for a Fourier
transform spectrometer

SO Optical Engineering, (Jun 1998) vol. 37, no. 636908, pp. 1882,
1883. Refs: 4. Available from: Aeroplus Dispatch.
ISSN: 0091-3286

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CT ***SHAPE MEMORY ALLOYS**; ***FOURIER TRANSFORM**
SPECTROMETERS; ***ELECTRIC WIRE**; **TACHOMETERS**; **SERVOCONTROL**

L9 ANSWER 17 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN DUPLICATE 2

ACCESSION NUMBER: 1991:86383 HCAPLUS

DOCUMENT NUMBER: 114:86383

TITLE: Application of isothermal martensite in GCr15
ball-bearing steel

AUTHOR(S): Xu, Zuyao; Chen, Yexin; Chen, Weiye

CORPORATE SOURCE: Shanghai Jiaotong Univ., Shanghai, Peop. Rep. China

SOURCE: Gangtie (1990), 25(6), 47-50

CODEN: KATIAR; ISSN: 0449-749X

DOCUMENT TYPE: Journal

LANGUAGE: Chinese

AB Isothermal **martensite** promotes stabilization of retained **austenite** in the quenched GCr15 **ball-bearing** steel upon cooling to subzero temperature, cycling of compressive stress, and aging at room temperature. Retained **austenite** was induced to transform to **martensite** under stress cycling to increase the contact fatigue life. Isothermal **martensite** stabilizes retained **austenite** and results in beneficial transformation-induced plasticity. The contact fatigue life of steel parts isothermally treated with a few percentages of isothermal martensite is 36% higher than that after subzero treatment and 18% higher than that treated by normal quenching and tempering. The dimensional stability of specimen treated isothermally is higher than that of specimens treated by normal quenching and tempering by 34%. The accommodation deformation induced by the isothermal martensite transformation leads to the mech. stabilization of retained austenite.

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IT 12173-93-2P, Martensite, preparation

RL: FORM (Formation, nonpreparative); PREP (Preparation)
(formation of, isothermal, in **ball-bearing** steel,
fatigue properties in relation to)

L9 ANSWER 42 OF 79 METADEX COPYRIGHT 2004 CSA on STN

ACCESSION NUMBER: 1986(6):12-732 METADEX

TITLE: The Influence of Cyclic Tempering on the Structure of
Ball-Bearing Steels.

AUTHOR: Ignat, C.

SOURCE: Cercet. Metal. (1983) 24, 335-340

DOCUMENT TYPE: Journal

LANGUAGE: Romanian

AB The effect of cyclic tempering on the relative amounts of residual
austenite, martensite and carbide is investigated in
ball-bearing steels. The carbide size, density and
distribution variation by groups of dimensions is also reported. A
thorough analysis of the results together with optic and electronic
microscopy based observations enable one to conclude that cyclic tempering
on the above-mentioned steels is a feasible technology for increasing size
stabilization. 4 reference-AA

TI The Influence of Cyclic Tempering on the Structure of **Ball-**
Bearing Steels.

SO Cercet. Metal. (1983) 24, 335-340

AB The effect of cyclic tempering on the relative amounts of residual
austenite, martensite and carbide is investigated in
ball-bearing steels. The carbide size, density and
distribution variation by groups of dimensions is also reported. A
thorough analysis of the. . .

L9 ANSWER 44 OF 79 METADEX COPYRIGHT 2004 CSA on STN

ACCESSION NUMBER: 1983(10):61-616 METADEX
TITLE: System for Train Accident Reduction-DOT STAR.
AUTHOR: Richardson, J.J.
NUMBER OF REPORT: NBS Spec. Publ. 652
SOURCE: National Bureau of Standards. Washington, D.C. 20234.
1983. 132-145. Accession Number: 83(10):72-537
Conference: Damage Prevention in the Transportation
Environment, Gaithersburg, Md., 21-23 Oct. 1981

DOCUMENT TYPE: Conference; Report

LANGUAGE: English

AB The Dept. of Transportation-System for Train Accident Reduction (DOT STAR) study at the Naval Surface Weapons Center (NSWC) is developing a prototype system to help reduce the number of train accidents. NSWC has taken military technology and applied it to develop an on-train anti-derailment system. This system can sense a local derailment or a hot bearing. Upon sensing these conditions, the system automatically applies emergency braking. Exploratory development hardware of the journal bearing thermal sensor successfully completed > 100 000 miles of travel. A **roller bearing** thermal sensor has also been designed. **NITINOL** is the key component used to sense overheated bearings. The derailment detector uses the impact of a sensor foot with the rail head to sense a local derailment. Upon generation of a hot box or a local derailment, the sensors initiate a thermal pulse battery. The electrical pulse activates the air valve which applies the train's brakes.-AA

NR NBS Spec. Publ. 652

SO National Bureau of Standards. Washington, D.C. 20234. 1983.
132-145. Accession Number: 83(10):72-537
Conference: Damage Prevention in the Transportation Environment,
Gaithersburg, Md., 21-23 Oct. 1981

AB. . . emergency braking. Exploratory development hardware of the journal bearing thermal sensor successfully completed > 100 000 miles of travel. A **roller bearing** thermal sensor has also been designed. **NITINOL** is the key component used to sense overheated bearings. The derailment detector uses the impact of a sensor foot with. . .

CT Railroad cars; **Roller bearings**: Service life; Journal bearings: Service life; **Shape memory**; Safety; Sensors; Fatigue failure; Temperature measurement

ACCESSION NUMBER: 1967:31211 HCAPLUS
 DOCUMENT NUMBER: 66:31211
 TITLE: Suitability of high-temperature resistant
 nickel-chromium alloys for dies for the extrusion of
 steel
 AUTHOR(S): Jahn, Thomas; Gaertner, Gerhard
 SOURCE: Neue Huette (1966), 11(11), 680-4
 CODEN: NEUHAM; ISSN: 0028-3207
 DOCUMENT TYPE: Journal
 LANGUAGE: German

- AB The high temps. and pressures (100 kg./mm.²) involved in extruding hot steel cause severe tool and die wear. High hot tensile strength, yield strength, resistance to wear and tear, and ductility are important properties for dies. An alloy with 8-10% W was worn out after 20-60 extrusions. Expts. were conducted with the wrought alloy LW 2325 containing C 0.10, SiO 42, Mn 0.26, Cr 15.68, W 5.25, Mo 1.38, Al 2.14, Ti 1.58, and Fe 1.68%, S, P, Cu, Ce, and B traces, and the balance Ni, HRC (Rockwell C Hardness) 39 as received and 31 after solution treatment and aging; LW 2326 with C 0.18, Si 0.34, Mn 0.39, Cr 14.91, W 1.39, Al 4.35, and Fe 1.68%, S, P, Cu, Ce, B, and Sb traces, and the balance Ni with resp. HRC 30 and 18; the Ni-Cr cast alloy I (C 0.13, Mn 0.47, Cr 12.04, Mo 2.80, Ti 1.76, Fe 4.8%, and the balance Ni (HRC 39, as received); and cast alloy II (C 0.24, Mn 0.32, Cr 11.92, Mo 2.25, Ti 1.68, Fe 6.7%, and the balance Ni) with HRC 39, as received). The die had a sleeve of W alloy and an insert of Ni-Cr alloy which can be changed after wear. **Ball bearing** tubes were extruded with outside diameter 23.6 mm., inside diameter 14.2 mm., and length 2.8 m. Billets with 73 mm. outside diameter, 16 mm. inside diameter, and 210 mm. length were used. The billets were preheated at 1100° in a salt bath. A 500 + 106 g. hydraulic extrusion press with a ram speed of 300 mm./sec. was considered. The change in cross section was 93%. The most reliable alloy was LW 2325 as received, which survived ≤400 extrusions. Aged dies of LW 2325 were too soft and survived ≤160 extrusions. Dies of 30 WCrV 34.11 survived ≤13 extrusions, of aged LW 2326 ≤285, cast alloy I ≤173, and cast alloy II ≤88 extrusions. LW 2325 was also suitable for extruding small steel profiles.
- SO Neue Huette (1966), 11(11), 680-4
 CODEN: NEUHAM; ISSN: 0028-3207
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- ST DIES STEEL EXTRUSION; **BALL BEARING** TUBES; STEEL EXTRUSION DIES
- IT Tungsten alloys, containing
(aluminum-chromium-iron-molybdenum-**nickel-titanium**-
and aluminum-chromium-iron-nickel-, for dies for extrusion of steel)
- IT Molybdenum alloys, containing
(aluminum-chromium-iron-**nickel-titanium**-tungsten-
and chromium-iron-**nickel-titanium**-, for dies for
extrusion of steel)
- IT Iron alloys, containing
(aluminum-chromium-molybdenum-**nickel-titanium**
-tungsten- and aluminum-chromium-nickel-tungsten- and
chromium-molybdenum-**nickel-titanium**-, for dies for
extrusion of steel)
- IT Chromium alloys, containing
(aluminum-iron-molybdenum-**nickel-titanium**
-tungsten-, aluminum-iron-nickel-tungsten-, and iron-molybdenum-
nickel-titanium-, for dies for extrusion of steel)
- IT Aluminum alloys, containing
(chromium-iron-molybdenum-**nickel-titanium**
-tungsten-, and chromium-iron-nickel-tungsten-, for dies for extrusion
of steel)

L9 ANSWER 65 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 1966:25760 HCAPLUS

DOCUMENT NUMBER: 64:25760

ORIGINAL REFERENCE NO.: 64:4708a-c

TITLE: Producing compressive stress in the surface layer of hardened steel

INVENTOR(S): Koistinen, Donald P.

PATENT ASSIGNEE(S): General Motors Corp.

SOURCE: 5 pp.; Division of U.S. 3,117,041

DOCUMENT TYPE: Patent

LANGUAGE: Unavailable

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
	-----	----	-----	-----	-----
	US 3216869		19651109	US	19630429 <--
AB	Steel articles hardenable to their centers are hardened to leave their surfaces in compression to improve the fatigue resistance, by altering either the composition or the austenitizing temperature of the surface of the article compared to the interior so that the transformation temperature of austenite to martensite is lower at the surface. Then in quenching, martensite is formed 1st in the interior where the resulting volume change occurs while the surface layer is plastic, and when the surface transforms later and expands, the interior is hard and resists further expansion, producing compressive stress at the surface. Steels containing 0.95-1.1% C and 1.3-1.6% Cr, commonly used for hardened ball bearings , is specially suitable for this process. Such a steel ball can be austenitized throughout at 1450°F., and subsequently heated briefly to 1900°F. so that only the surface layer is affected, before the entire ball is quenched in oil. At about 500°F. the interior transforms to hard martensite, while the surface layer does not transform until the ball temperature falls to 250°F. when compressive stress results from its expansion. The same result can be obtained with a single 30-min. austenitizing at 1575°F. in an atmosphere containing 5% NH ₃ , when N diffuses into the surface layer to a depth of about 0.015 in. On quenching in oil, martensite forms at a lower temperature in the nitrided layer than in the interior. By treating with N for 5-10 hrs. at 975-1050°F., the layer stressed in compression on quenching was thickened to 0.045 in. Cr, Ni, or B can be applied to the surface and diffused inward to obtain the same effect as with N on hardening.				
PI	US 3216869	19651109			
	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
	-----	----	-----	-----	-----
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IT **Bearings**
(ball, with compressive surface stress)

L9 ANSWER 68 OF 79 HCAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 1964:402543 HCAPLUS

DOCUMENT NUMBER: 61:2543

ORIGINAL REFERENCE NO.: 61:375f-h,376a

TITLE: Complete transformation of austenite in hardened high-carbon steel

INVENTOR(S): Mantel, Edward R.

PATENT ASSIGNEE(S): General Motors Corp.

SOURCE: 3 pp.

DOCUMENT TYPE: Patent

LANGUAGE: Unavailable

PATENT INFORMATION:

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
	-----	----	-----	-----	-----
	US 3131097		19640428	US	19620223 <--
AB	High-C Cr steel roller and ball bearings are hardened and tempered with dimensional stability, no retained austenite, and hardness maintained at 62-3 Rockwell C, by quenching in oil at 90-100°F. from 1750-1825°F., re-austenitizing at 1550-1600°F. and similarly quenching, immediately refrigerating 2 hrs. at -110°F., warming slowly, and tempering at 400-500°F., preferably for 4 hrs. at 400, 4 hrs. at 450, and 2 hrs. at 500°F. Double austenitizing and quenching give a finer structure, higher-C martensite, and greater strength, and with the cold treatment permit higher tempering, to transform all the retained austenite, without dimensional change or softening. When test bars 0.25 + 0.5 + 0.75 in. of steel containing C 1.01, Mn 0.34, Si 0.26, Ni 0.12, Cr 1.41, Mo 0.02, S 0.02, and P 0.008% were so treated, first 30 min. at 1800°F., then 1 min in oil at 95°F., 30 min. at 1575°F., 1 min. in the oil again, and within 1 min. cooled to -110°F. for 2 hrs. and tempered 10 hrs. as stated above, the hardness was 62.5 Rockwell C, precision elastic limit by foil strain gage 88,000 lb./in.2 and tensile strength 314,000327,000 lb./in.2 Specimens conventionally heat treated and containing 2-3% retained austenite had 44,000 lb./in.2 elastic limit and 59-60 Rockwell C hardness.				
PI	US 3131097		19640428		
	-----	----	-----	-----	-----
PI	US 3131097		19640428	US	19620223 <--
AB	High-C Cr steel roller and ball bearings are hardened and tempered with dimensional stability, no retained austenite, and hardness maintained at 62-3 Rockwell C, by quenching in oil at 90-100°F. from 1750-1825°F., re-austenitizing at 1550-1600°F. and similarly quenching, immediately refrigerating 2 hrs. at -110°F., warming slowly, and tempering at 400-500°F., preferably for 4 hrs. at 400, 4 hrs. at 450, and 2 hrs. at 500°F. Double austenitizing and quenching give a finer structure, higher-C martensite, and greater strength, and with the cold treatment permit higher tempering, to transform all the retained austenite, without dimensional change or softening. When test bars 0.25 + 0.5 + 0.75 in. of steel containing C 1.01, Mn 0.34, Si 0.26, Ni 0.12, Cr 1.41, Mo 0.02, S 0.02, and P 0.008% were so treated, first 30 min. at 1800°F., then 1 min in oil at 95°F., 30 min. at 1575°F., 1 min. in the oil again, and within 1 min. cooled to -110°F. for 2 hrs. and tempered 10 hrs. as stated above, the hardness was 62.5 Rockwell C, precision elastic limit by foil strain gage 88,000 lb./in.2 and tensile strength 314,000327,000 lb./in.2 Specimens conventionally heat treated and containing 2-3% retained austenite had 44,000 lb./in.2 elastic limit and 59-60 Rockwell C hardness.				
IT	12173-93-2, Martensite (formation, from residual austenite in steel for bearings)				
IT	12244-31-4, Austenite				

(residual or retained, **martensite** formation from, in steel
for bearings)

L Number	Hits	Search Text	DB	Time stamp
5	20	(shape adj memory) same (ball adj bearing\$ or ballbearing\$)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/01/06 11:00